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**Dividing the Operational Art Pie:
What Are the Slices?**

**A Monograph
by
Major Glenn Davis
Infantry**



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ABSTRACT

DIVIDING THE OPERATIONAL ART PIE: WHAT ARE THE SLICES? by Major Glenn W. Davis, USA, 61 pages.

This monograph discusses the fundamental functions of operational art and assesses how well they are addressed by current doctrine. Its focus is upon operational art as applied to conventional warfare; that zone where the theater of operations commander views his theater and is concerned about the design, organization, and conduct of campaigns.

The monograph first examines the definition of activity, function, and operational art. Next, the writings of several noted theorists are analyzed to determine the theoretical functions of a force at any level of warfare. Those theoretical functions are then applied to our current definition of operational art and tested against an historical analysis of the following campaigns or major operations: the American Civil War Vicksburg Campaign, the World War I St. Mihiel Offensive, and World War II Operational Jael and Rhone Valley Campaign. Finally, an analysis of three current doctrinal manuals--FM 100-5, Operations, FM 100-6, Large Unit Operations, (Coordinating Draft), and TRADOC Pamphlet 11-9, Blueprint of the Battlefield--and a proposed descriptive model for operational level functions are evaluated against seven criteria determining their relative degree of utility and adequacy in addressing the fundamental functions of operational art.

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DIVIDING THE OPERATIONAL ART PIE:
WHAT ARE THE SLICES ?

To persuade our mind to become flexible and recipient we must think in functions.¹

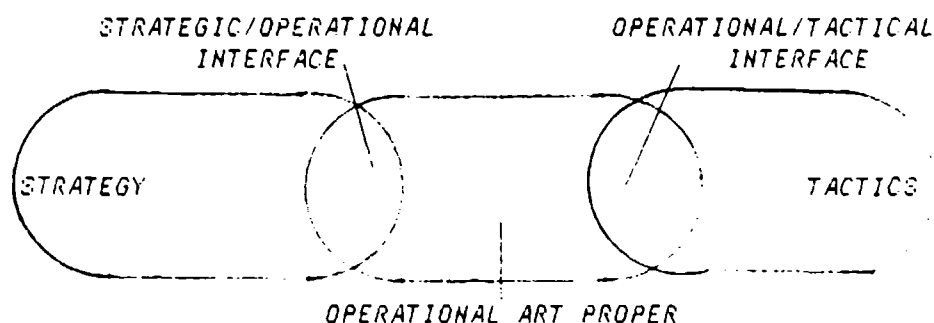
J.F.C. Fuller
"Tactics and Mechanization"

War and the preparation for war are built upon a wide assortment of facts and assumptions, the collection of which form strategy, operations, and tactics. Sorting these fundamentals into a methodology which applies to an appropriate level of war is a significant task--as many pieces may have overlapping or underlapping characteristics. It is helpful to construct some basis for sorting these innumerable facts, not only to divide them into component parts, but also to separate the subordinate parts from the more significant ones. The fundamental functions of operational art, the division of war linking strategy to tactics, are inherently complex and equally difficult to unravel. The purpose of this paper is to determine the fundamental functions of operational art and assess how well they are addressed by current doctrine. This inquiry requires a brief explanation of the term "fundamental" and definitions for function, activity, and operational art.

The term "fundamental" applies to most any subelement of a larger element that forms the basis for or becomes an integral part of its existence--the basic element. A function is the expression of some action as a verb, e.g. to protect. An activity is the expression of some action as a noun, e.g. protection. Each has the

same effect, but expressed in a different manner. Some analysts use the infinitive form, others use the nominative. For purposes of this study they will be considered interchangeable.

Our current doctrine defines operational art, in a broad context, as the linkage between tactics and strategy. FM 100-5, Operations states that "operational art is the employment of military forces to attain strategic goals in a theater of war or theater of operations through the design, organization, and conduct of campaigns and major operations."² It deals on both ends of the linkage between strategy and tactics. It is almost invariably joint in nature and frequently combined. An analysis of its interface at each end of the link led to a discovery of not one, but three distinct sub-areas, each different in scope and activity yet united in aim. (see Figure 1). These sub-areas are the operational-tactical interface, the strategic-operational interface, and operational art proper.



OPERATIONAL ART LINKAGE
Figure 1

At the upper end, the connection to strategy, operational art is truly a military art--the fitting of means to the tasks at hand, the analysis of complex situations, and the designation of military objectives which, when secured, will fulfill the needs of strategy.³ The theater of war commander operates in this strategic-operational interface zone to ensure the military resources under his control work to achieve the desired strategic goals. The commander transforms these strategic military concepts into decisive instructions (in a theater of war campaign plan) that are useful at the theater of operations: who, when, where, why, how.⁴

At the lower end, the connection to tactics, operational art addresses the ways in which major operations are designed and pursued in a sub-element of a theater of operations--determining when and where to fight, disposing forces in anticipation of battle, and acting to get the greatest advantage of tactical actions whether or not fighting takes place.⁵ Lower operational commanders operate at this operational-tactical interface zone insuring the elements of combat power--maneuver, firepower, protection, and leadership⁶-- are sufficient to meet the military objectives designed by the theater of operations commander.

The area between--operational art proper--links the theater of war campaign plan to major operations with a theater of operations campaign plan. The theater of operations commander, practicing "pure" operational art, concentrates on applying military power toward the strategic objectives assigned by the theater of war

commander. The optimum organization of this military power will help determine the best way to divide operational art. The context of further discussions will focus on operational art as it applies to this middle area in conventional warfare, that zone where the theater of operations commander views his theater and is concerned about the design and conduct of campaigns.

The elements of operational design, as outlined in FM 100-5, Operations provide a unifying set of considerations which analyze the theater and the subordinate actions required to achieve strategic aims. These considerations include: conceptualizing the military conditions necessary to achieve the strategic aim; visualizing the sequence of operations most likely to achieve those conditions; and finally, the employment of resources necessary to produce the desired sequence of actions.⁷ Together these considerations comprise the foundation for building a campaign plan. However, as a guide to practicing operational art, they only provide a starting point. The operational artist must also ask the question, "What are the fundamental functions my force must perform to execute the actions required to reach my goal?" We may begin to answer this question by examining what several noted theorists have said about the functions of operational art.

There are two schools of thought concerning the origins of operational art. The first is articulated in James J. Schneider's article "The Loose Marble and the Origin of Operational Art." According to Schneider's analysis, true operational art did not begin

until the middle of the nineteenth century as a product of the Industrial Revolution, when the classical battlefield was changed for three reasons: demographic, geopolitical, and technological.⁸ The other school of thought says that operational art has existed since the development of coherent plans to achieve strategic aims through tactical actions--it was just never called by that name.⁹ I will use the broader definition, which has its basis in the doctrine outlined in FM 100-5. The writings from three theorists are examined: J.F.C. Fuller, Sun Tzu, and Baron Henri de Jomini.

THEORY

J.F.C. Fuller attempted to change the way the battlefield is viewed when he said, "To persuade our mind to become flexible and recipient we must think in functions".¹⁰ Although Fuller's writings are oriented on tactical actions, he addresses functions applicable to a force at any level of war.

First, we have got to find our enemy and simultaneously prevent him from finding us. Once we have found him we must hold him, that is we must attempt to restrict his mobility. Thirdly, we want to hit him, and simultaneously, fourthly, we want to protect ourselves from his blows. Once we have exhausted him, fifthly, we want to smash him to pieces.¹¹

He summarizes these functions of war as: to discover, to hold, to hit, to protect, and to smash.¹² Hidden within the first narrative line but not listed is the function "to blind".¹³

Although not specifically listed as functions, Sun Tzu attempts

to describe the constituent parts of war in his writings with these words:

Now war is based on deception. Move when it is advantageous and create changes in the situations by dispersal and concentration of forces."¹⁴... What is called 'foreknowledge' cannot be elicited from spirits, nor from gods, nor by analogy with past events, nor from calculations. It must be obtained from men who know the enemy situation.¹⁵... He who knows the art of the direct and indirect approach will be victorious. Such is the art of manoeuvring.¹⁶... Thus, that is of supreme importance in war is to attack the enemy's strategy; next best is to attack his army.¹⁷... The experts in defence conceal themselves as under the ninefold earth; those skilled in attack move as from above the ninefold heavens.¹⁸... Having paid heed to the advantages of my plans, the general must create situations which will contribute to their accomplishment. By 'situations' I mean that he should act expediently in accordance with what is advantageous and so control the balance¹⁹.

These maxims suggest the following functions: to deceive, to foresee, to maneuver, to attack, to protect, to move, and to control.

Jomini's writings also highlight the functions in war, especially at the levels of grand tactics and strategy.

Grand tactics is then the art of well combining and well conducting battles.²⁰... The first point in a plan of operations is to be assured of a good base; this name is applied to the extent of the frontiers of a State from whence an army will draw its resources and reinforcements.²¹... Finally, that strategic manoeuvres for cutting off from its communications before battle, and thus attacking it in reverse, *without losing our own line of retreat*, are of a much more sure and much greater effect and moreover do not require any disconnected manoeuvre in the combat.²²... For the same reason that it is necessary to profit of every occasion for surprising our adversary, it is important also to take every necessary precaution for securing ourselves against such enterprises.²³... One of the most important means of well combining skillful manoeuvres of war, would unquestionably be never to order them except upon exact knowledge of what the enemy might be doing.²⁴

Boiled down to their essence, Jomini's functions are to organize, to control, to support, to maneuver, to surprise, to secure, and to know.

The three sets of functions derived from the theorists were not uniform. To attempt any direct connection among the derived sets--as a whole--would be unfair. Each theorist spoke from a different frame of reference, with different intent and emphasis, and on different levels. However, if one examines the components of each set one discovers some characteristics which repeat themselves. A synthesis of the three theorists' writings suggests the following composite functions of a force: to discover, to foresee or know; to deceive or blind; to surprise; to move or maneuver; to organize; to control; to smash, attack, or hit; to hold; to protect or secure; and to support.

These theoretical functions must now be applied to our current definition of operational art and tested against historical analysis. The American Civil War Vicksburg Campaign, the World War I St. Mihiel Offensive, and World War II Operation Jael and Rhone Valley Campaign represent campaigns and major operations which U.S. Army forces conducted operational art. The purpose of this examination will be to validate the previously defined theoretical functions and discover other possible significant functions in the practice of operational art. As these campaigns and major operations are discussed, one must keep in mind that operational art involves fundamental decisions about when and where to fight, whether to

accept or decline battle²⁵, and the fitting of means to the tasks at hand.²⁶

HISTORICAL ANALYSIS

CIVIL WAR

By late 1862 Union victories in Memphis, New Orleans, Iuka, and Corinth, compelled Confederate forces to consolidate at Chattanooga. This withdrawal exposed Vicksburg, the strongest point left on the Mississippi and the main link between the Confederate forces west and east of this river. The fall of Vicksburg and the capture of Chattanooga by the Federal Army would create the military conditions of cutting the Confederate forces in two, disrupting the flow of supplies and reinforcements from the East to the West, as well as gaining a network of roads, rails, and waterways for future operations targeted deep in the Confederate heartland. Analysis of the campaign to seize Vicksburg starts with the operational setting of both forces.

Vicksburg Campaign

When General G.H. Halleck was appointed General-in-Chief of all Union land forces, he turned over his western command of ground forces to General Ulysses S. Grant and General Don Carlos Buell. Grant commanded the Armies of the Mississippi and Tennessee located at Corinth.²⁷ Buell, subsequently replaced by General William S.

Rosecrans, commanded the Army of the Ohio, later named Army of the Cumberland, located near Nashville.

In the aftermath of his overland attempt at Vicksburg in December 1862, Grant again attempted a maneuver down the Mississippi. From Sherman's failed attack north of Vicksburg, he realized the city was unapproachable from the south, west, or north. He therefore concluded that he must attack from the east. In early 1863 Grant ordered General Nathaniel P. Banks, Butler's replacement, to make his way upriver to join the Army of the Tennessee at Vicksburg, reducing Fort Hudson enroute. In February 1863 Grant's forces were transported down river to Milliken's Bend, ten miles above Vicksburg, where a new base of operations was established. By mid-April Grant began working out his plan of getting a major force east of Vicksburg. He counted on surprise to assist him.

Grant left Sherman's corps above Vicksburg and moved the rest of his army overland through Hard Times, below Vicksburg, opposite Grand Gulf. With Sherman's corps and some gunboats demonstrating up the Yazoo River, Grant used the remaining gunboats and transports (which ran past the Vicksburg batteries) to re-cross 41,000 troops 10 miles below Grand's Gulf. Sherman was ordered to stop the demonstration, consolidate forces, and attack south. Pemberton, commander of the Confederate forces at Vicksburg, concentrated on looking north. Joseph E. Johnston, replacing Pemberton as overall commander of the Confederate forces in the West, poised at Jackson, Mississippi, ready to strike. In a surprising move Grant cut loose from his supply

lines with only three days' packed rations, 120 wagons of hardtack, coffee, salt, sugar, and two wagons of ammunition per regiment.²⁰ Further resupply was assured when combat forces were used to protect the supply lines from Bruinsburg to the Union forces.

By 1 May, with all his communication north of Vicksburg and relatively secure interior lines, Grant attacked northeast along the Big Black River. Simultaneously, Sherman mounted an assault south upon Haynes Bluff with an intermediate objective of Johnston's 9,000 man force located at Jackson. To take Vicksburg from the east, however, required isolating Johnston, not only to prevent him from reinforcing Pemberton or enveloping Sherman but also to prevent his attacking Grant's exposed rear as Grant turned inland.

To accomplish this, Sherman immediately used a cavalry raid to incapacitate one of the two rail lines that Johnston depended upon to supply his army at Jackson as well as the line leading to Vicksburg. Sherman was left to isolate Johnston and destroy the remainder of Confederate supplies and railroads at Jackson. Grant had now placed himself between the two parts of the Confederate Army, one under Pemberton at Vicksburg and the other under Johnston at Jackson, fifty miles east.²¹ Grant, with relatively secure lines of operation, turned west against Pemberton. In an effort to stop Grant's advance, Pemberton probed unsuccessfully for Grant's nonexistent lines of communications. Eventually, he was forced to fall back and protect his own.

Two additional battles ensued, one at Champion Hill and the

other at Big Black River, as Grant emerged victorious. On 18 May, with Pemberton and Vicksburg surrounded, one of Grant's key military conditions for this campaign was achieved: cutting off the army of Pemberton defending Vicksburg. After two unsuccessful assaults, Grant began siege operations leaving Sherman's corps as a mobile force to counter any possible attempt by Johnston to relieve Vicksburg. Without provisions, informed by Johnston that he could not relieve the siege, and believing his enfeebled army physically incapable of attempting a breakout, Pemberton surrendered on 4 July.³⁰

The 1863 Vicksburg campaign was a showcase for the development of operational maneuver as an alternative to direct tactical confrontation without the operational advantage.³¹ Operational maneuver was linked directly to distributed operations, tactical envelopment, protection of the force, and lines of communications. Forces not in contact were moved by different modes--rail, overland, and river boat--in an attempt to support operations proposed by both Grant and Johnston. Also, Grant knew more about the location and disposition of Confederate forces than either Pemberton or Johnston. Clearly, the initiation and sustainment of these campaigns and major operations were tied to logistics. Equally important was the method in which Grant organized his ground and naval forces to meet the tasks at hand. The most evident operational level functions performed during this campaign were to move, to maneuver, to know, to blind, to secure, to support, and to direct.

Movement was employed when Union forces not in contact and supplies were transported by naval assets down river to Milliken's Bend in support of Grant's operational concept. Maneuver was employed as Grant's forces traveled overland and secured a positional advantage over Pemberton's forces 10 miles below Grand's Gulf. Gaining intelligence through the use of informants and spies as to the location and disposition of Confederate forces and terrain provided Grant the advantage of time, space, and action before and during battle. Through Sherman's northern demonstration, Grant attempted to blind Pemberton as to the true location and intent of his operations before crossing the Mississippi River. Security was employed when Grant cut loose from his vulnerable supply lines and used Sherman's forces to protect his flank and rear from possible attack as he turned west to attack Vicksburg. Continuous support provided by sea and overland routes allowed Union forces to maintain their positional advantage below Vicksburg. Finally, direction was employed by Grant to accomplish his operational concept of gaining a positional advantage below Vicksburg, isolating Johnston at Jackson, Mississippi, and cutting off Pemberton's force defending Vicksburg.

WORLD WAR I

World War I saw the introduction of modern weaponry onto the battlefield and a return to large unit operations for the United States forces. The new weapons included airplanes, long-range

artillery, tanks, and machineguns. The use of these advanced arms increased the U.S. Army's force characteristics of lethality, versatility, and sustainability. We will examine the effects of these advances on the functions of operational art in World War I by analyzing the U.S. First Army's offensive to seize the St. Mihiel Salient.

St-Mihiel Offensive

The St.-Mihiel offensive was the largest American military operation since the Civil War. By mid-1918, the United States had twenty-nine divisions in France with additional new forces arriving from the United States. Three divisions had seen action in the second battle of the Marne and the U.S. I Corps was holding a sector of the front. Mainly though, American units from battalion to divisional size were scattered along the front reinforcing French or British operations. At most, two U.S. divisions, side by side, had been committed to an active sector.³¹

From July 1918 the Allies conducted an almost continuous offensive in the Western Front. The first operations were directed toward the four salients created by the Germans--Aisne-Marne, Amiens-Somme-Noyon, Lys-Ypres, and St.-Mihiel. The St.-Mihiel Salient protected Metz and the Brey iron mines, and dominated two key railroad lines. Seizure of these rail lines would prevent German lateral mobility and sustainment efforts. In 1915 the French made an

attempt to reduce the salient, but lacked the manpower and resolve for a prolonged campaign. The salient remained in German hands and an accepted part of the French line.³²

General John J. Pershing, commander of the U.S. First Army, insisted that reduction of St.-Mihiel Salient become an American responsibility. He maintained the intent that U.S. expeditionary force was to be "a separate and distinct component of the combined forces, the identity of which must be preserved."³³ Although these desires ran counter to both French Marshal Foch and British Field Marshal Haig, Pershing's resolve stood firm. Reluctantly, Foch supported Pershing's plan for the reduction of the St.-Mihiel Salient.

Until 1918, German capability to extend its operations past the St.-Mihiel and other salients had consistently failed for three reasons: lack of logistic mobility, lack of operational mobility, and lack of mobile tactical fire support.³⁴ Once any breakthrough had been made, the Germans did not have the means to keep an adequate flow of ammunition, food, or supplies moving to advancing forces. Additionally, the lack of any fast-moving mobility assets kept breakthrough troops from exploiting any penetration or gap in the Allied lines. Finally, when a breakthrough occurred, the front-line infantry quickly outran its artillery support, which was unable to advance through the battlefield quagmire created by its own heavy bombardments. The combined effect of these problems resulted in the Germans losing the momentum initially created by successful tactical

penetrations.³⁵

Knowing these weaknesses and the American plan for attack of the St. Mihiel Salient, German General Erich F.W. Ludendorff evacuated some 50,000 German troops from within the salient and consolidated his forces to a more stable and shorter defensive line on 6 September. By 12 September, the onset of bad weather convinced the Germans that the Allied attack would be postponed. But Pershing thought the weather added an element of surprise to his attack plans and launched the operation as scheduled.

The air and ground attack on 12 September 1918 was completely successful. A conglomerate Allied air force of some 600 American, French, Italian, and Portuguese planes was used to conduct the first large-scale, coordinated air action of the war.³⁶ The First Army directed its attack on both bases of the salient as French forces held the nose. The converging ground attacks, preceded by a four hour, one million round artillery bombardment, met at Hattonchatel by nightfall. In one day the combined U.S. and Allied force had penetrated the total depth of the German defensive lines and trapped the forces remaining in the salient. Within four days the encircled German forces suffered a moral collapse and surrendered in mass. More than 16,000 prisoners, 443 guns, and great stocks of material were taken.³⁷

U.S. First Army operations to sever the St. Mihiel Salient reveal three essential elements relating to operational art. First, they made use of fires both to gain a position of advantage over the

enemy and to conduct operations with the greatest economy of force. Second, they demonstrated the requirement to organize joint and combined forces for the conduct of campaigns and major operations. Finally, they set the stage for the future operations by securing vital rail and road networks for continued mobility and sustainment efforts. The key operational level functions performed during this operation were to maneuver, to foresee, to direct, to surprise, to smash, to support, and to organize.

Maneuver was employed as the First Army gained a positional advantage for its attack on both bases of the salient as French forces held the nose. General Pershing foresaw the effect of this assault against the German forces through this operation. Although the specifics were not outlined, Pershing directed his forces in seeking to sever the salient and isolate the remaining enemy forces. Surprise, albeit more tactical than operational, was employed when Pershing launched the operation as scheduled despite the adverse weather conditions. The massive pre-attack air and artillery bombardment (operational fires) smashed the German forces remaining in the salient, allowing the American forces to penetrate to the total depth of the German defensive lines and trap the forces remaining in the salient. Although the operation lasted only four days, a massive logistics effort was required to support this joint and combined ground, air and artillery effort. Finally, this operation employed organization in utilizing joint and combined forces to meet the tasks at hand.

WORLD WAR II

During World War II the tremendous advanced technology introduced in World War I changed not only the depth of the battlefield, but also the manner of force organization. These technological advance included: more efficient, mobile, armored weapon systems; advanced air support and ground air defense systems; longer range, rocket-delivered fires; and increased communications transmission and intercept capabilities.³⁸ We will examine the effect of these advances on the functions of operational art in World War II by analyzing Operation Jael and the Rhone Valley Campaign in southern France.

Operation Jael

Operation Jael, the code name for the overall deception plan for the Allied invasions of France, contained several subordinate plans designed to contain enemy forces in Scandinavia (Fortitude North), portray a threat against the Pal de Calais (Fortitude South), cover the eastern Mediterranean (Zeppelin), and cover the western Mediterranean (Ironsides, Vendetta, and Ferdinand).³⁹ There were three nonmilitary deception schemes: Plan Graffham, a diplomatic deception in support of Fortitude North; Royal Flush, a second diplomatic deception to exploit the expected change in the attitudes of neutrals

to the Allied cause after the successful invasion of the continent; and Copperhead, the notional journey of General Montgomery to Algiers.⁴⁰

Operation Fortitude (North and South) was designed to cause the Germans to array their forces against false threats and thus ease the way for the actual invasion--Operation Overlord.⁴¹ It was but one major part of Operation Jael (also known as Plan or Operation Bodyguard) which utilized intelligence, counterintelligence, special operations, political warfare, and combat forces to deceive Hitler about Allied global strategy.⁴²

Fortitude North depicted a mid-July 1944 attack launched from Scotland against southern Norway followed by a maximum ground effort toward Pas de Calais. Assaulting south Norway would be fictitious British-American-Russian units. Fortitude South envisioned the Allied main effort after the Norway invasion centered on Pal de Calais and led by General George S. Patton and the fictitious 1st Army Group. The invasion force would consist of 12 divisions, after expanding to 50.⁴³ Various units stationed in eastern and southeastern England, as well as Patton's arrival from Italy, supported the deception story. In both plans, radio simulation was the main support mechanism. Also, the intent of both operations was to fix German forces in Pal de Calais and southern Norway and prevent reinforcement of German units at Normandy.

Operations Ironside, Vendetta, and Ferdinand supported both invasion plans Overlord and Dragoon (operations in the western

Mediterranean) by directing threats to the Marseilles area to fix the German XIX Army. Operation Ironside attempted to portray an Allied attack on the French Atlantic coast, near Bordeaux, three days after the Normandy landings. Unfortunately, the naval support elements of the plan were purely fictional, and since there was no spare aircraft for bombing, the deception had virtually no chance of success.⁴⁴ Operation Vendetta was intended to convince Hitler that an Allied invasion of the south of France was imminent. The supporting order of battle consisted of 91st US Infantry Division (actual) and large numbers of fictitious troops, some of which belonged to the U.S. Seventh Army. The operation began with bombings in North Italy and the Rhone Valley, sabotage of enemy communications sites, and the reconnaissance and raiding of notional assault sites. To confuse the enemy further, Operation Ferdinand was established to reduce the enemy's strength and vigilance in the south of France by portraying a story of an all out invasion of Genoa, Italy.

When resources were sufficient to demonstrate the story, deception activities in World War II led to an advantage over the enemy. The effectiveness of these activities can be viewed best as an offensive tool. They aided the achievement of surprise by concealing the time, scope, and target area of the invasion and rendered a decisive number of enemy forces ineffective following the establishment of the initial beachhead. Allied leaders, through ULTRA intercept transmissions, received valuable feedback on the success or failures of various deception efforts.⁴⁵ It is important

to remember that successful deception operations consisted of an organized, integrated effort on the part of joint and combined forces to synchronize intelligence, counterintelligence, special operations, political warfare, combat forces, and tactical deception measures to gain a relative advantage in the theater. However, the analysis of this operation suggests that deception is an integral function of sound campaign planning and execution. The fact that it requires numerous other functions to support it, stresses its comprehensive nature. The other major operational level functions performed during this operation were to move, to know, to attack, to hold, to protect, to support, to control, and to organize.

Movement was employed when forces and supplies not in contact were transported to various areas to support the deception story. ULTRA transmissions allowed the Allies to know the success or failures of the connecting deception efforts. Air and limited ground attacks were conducted in North Italy and the Rhone Valley. Also enemy communications were attacked and the notional assault sites were reconnoitered and raided in support of the plan. German forces were held in Fal de Calais and southern Norway in anticipation of the other Allied landings. Operations Ironside, Vendetta, and Ferdinand supported both invasion plans Overlord and Dragoon by holding the German XIX Army in place at Avignon in southern France. Operation Fortitude (North and South) caused the Germans to array their forces against false threats and thus protected the actual invasion site and forces engaged in Operation Overlord. Support was provided by

fictitious orders of battle, radio simulation, naval support elements, and increased reconnaissance activities. The imitation of radio nets and command structure presented the false picture of command and control. Finally, the organization of joint and combined assets was crucial in matching these interconnecting plans to the assets at hand.

*Truscott's Rhone Valley Campaign-
Operations in Southern France*

The objectives of Operation "Dragoon" were threefold. First, to secure the port of Marseilles, vital to the logistical support of the Allied drive into Germany. Second, to cut off German units in western and southwestern France. Finally, to link up and provide security for the southern flank of advancing "Overlord" forces (12th Army Group). The U.S. Seventh Army, consisting of the U.S. VI Corps, French II Corps, and a provisional airborne division, made an amphibious landing and air drop on the Cote d'Azur in southern France on 15 August 1944. This joint and combined operation actually began in early August with a complex cover plan.

Part of the elaborate deception plan, derived from Plan Jael, included Allied air attacks against lines of communications, airfields, and submarine bases in the Po Valley areas of Italy, as well as in the Marseilles-Toulon region.⁴⁶ Its purpose was to prevent the German XIX Army from reinforcing major elements along the Cotentin Peninsula and the forces defending Seventh Army landing

sites in the vicinity of Marseilles. This required an extensive bombing of communications sites and road and rail lines leading into the invasion areas. By 10 August virtually all major communications and routes into the invasion site had been blocked.⁴⁷

Major General Lucian K. Truscott's VI Corps made the initial assault landings supported by over 1,000 ships from five navies--American, British, Australian, French, and Greek. Air support came from the 12th US Air Force utilizing approximately 2,100 aircraft to bombard the landing areas.⁴⁸ With relatively minor resistance on the beachhead during the first day, Truscott's forces quickly pushed north in exploitation.

His plan was to strike deep into the Rhone Valley, cut the German withdrawal routes, and encircle the German XIX Army. Truscott's plan was implemented at the same time German forces were suffering severe losses in the Argentan-Falaise pocket. As a result of these losses, the German XIX Army was ordered to withdraw from southern France via the Rhone Valley. Operating on minimal logistical support, Truscott's forces raced north and passed the Germans then turned west to close the trap at Montelimar.⁴⁹

Truscott's forces were unable to close the defile at Montelimar for two reasons. First, operating on a logistical shoestring caused shortages in ammunition. Second, German Panzer counterattacks were successful in keeping the withdrawal route open. However in 14 days, Truscott's VI Corps traveled approximately 175 miles and practically destroyed the German XIX Army, capturing over 32,000 prisoners and

1,316 of its 1,481 guns.⁵⁰ Meanwhile, the French II Corps, the follow-on assault force, landed mid-day 17 August and began its drive toward Toulon and the port of Marseilles. The French component captured both, taking over 47,000 prisoners.⁵¹

Truscott's Rhone Valley campaign reveals the interdependent relationships that exist among operational deception, maneuver, movement, fires, and support in achieving stated objectives. Each of these functions played a key role in its success or potential for greater success. The salient operational level functions performed during this campaign were to move, to command and control, to maneuver, to attack, to hold, to deceive, to support, to protect, and to organize.

Movement was employed when elements of the U.S. Seventh Army conducted amphibious landings and air drops into the Marseilles area of southern France. Command and control was employed in both the assault landing and advance of forces inland. Maneuver was employed when Truscott's forces exploited a tactical success and raced north then west to close the withdrawal routes for the German forces. Operational fires were used to attack the German forces with approximately 2,100 aircraft bombarding the landing areas. Additionally, the extensive bombing of communications sites and road and rail lines leading into the invasion areas not only interdicted the invasion site, it also held the German XIX Army forces to a single defile for withdrawal. Deception was employed as part of Plan Jael to prevent the German forces from concentrating at the invasion

site. Also, support for the operation was evidenced through the use of naval and air assets. The lack of support in ammunition resulted in VI Corps' being unable to encircle the withdrawing German XIX Army. Protection was evident in Truscott's linkup with and protection of the southern flank of the advancing 12th Army Group. Finally, organization was demonstrated when joint and combined forces were transported and utilized to conduct sea, air, and land actions in support of assigned military objectives.

SUMMARY

The Civil War, World War I, and World War II historical examples presented validate most of the previously defined theoretical functions. However, some of the same functions discovered in these historical examples appear to take on a broader meaning and hence require new categorization. Appendix A provides a recapitulation of the derived functions in history as compared to theory. In summary, the fundamental functions derived from history were maneuver, movement, intelligence, fires, deception, protection, support, organization, and command and control. This historical analysis must now be supplemented by an examination of the changes that have affected operational art since World War II and an analysis of how current doctrine addresses the functions of operational art.

CONTEMPORARY ANALYSIS

Since World War II a number of fundamental changes have occurred in technology, Army readiness, and mission requirements. Of the three, rapidly changing technology and capabilities of forces have altered the emphasis and application of certain functions of operational art.²² Those functions affected depend upon the area of application. However, the development of electronic warfare, stealth, precision-guided munitions and advanced observation and firing platforms have expanded the battlefield further into the vertical dimension, adding to requirements for synchronization of functions in time, space, and aim.

Also since World War II, the Army's requirement for readiness has changed. Today, the United States Army maintains both forward deployed forces in Europe and Korea as well as contingency and reinforcement corps in the United States to challenge identified threats and provide support to allied countries. This increased readiness posture is tied to a wider variety of mission requirements facing our forces since World War II. The defense of NATO has been the main focus of our efforts for many years. But with the perceptions of a decreasing WARSAW Pact threat, the focus of our mission requirements is leaning toward low and mid-intensity environments anywhere in the globe. The range of requirements now extends from traditional combat operations to peacekeeping, nation-building, and unique missions.²³ The resurgence of special operating forces and civil affairs units reflects a shift in

capabilities and requirements for force employment for other than combat activities.

The implications of these changes are three-fold. First, operational art is now more complex. Second, operational art could be practiced in a wide variety of settings. Finally, our doctrine must be projected forward to meet these changes.

Now that we have examined the recent changes that will affect the functions of operational art, one may assess what contemporary doctrine defines as operational level functions. Three major or emerging doctrinal manuals provide varied descriptions of the fundamental functions of operational art (Appendix B). FM 100-5, Operations, describes seventeen functional activities requiring synchronization in time, space, and aim (see Appendix B).⁵⁴ Although not described as operational level functions, the manual does address in similar wording, the dynamics of combat power--maneuver, firepower, protection, and leadership-- which decide the outcome of campaigns, major operations, battles, and engagements.⁵⁵ FM 100-6, Large Unit Operations, (Coordinating Draft) describes five functions normally associated with tactical operations having analogues at the operational level.⁵⁶ These are maneuver, fires, intelligence, deception, and sustainment. TRADOC Pamphlet 11-9, Blueprint of the Battlefield, outlines six operational operating systems (OOS)--major functions performed by joint and combined operational forces.⁵⁷ These are movement and maneuver, fires, intelligence, protection, command and control, and support.

After an examination of the definition of operational art and a synthesis of history and theory, I have selected seven operational level functions that link strategic aims to tactical actions. These functions are maneuver, fires, intelligence, protection, deception, support, and organization. Justifying my selection of the fundamental functions of operational art requires some explanation as to their application in operational art proper.

Operational maneuver is the "disposition of forces to create a decisive impact against the enemy by either securing the operational advantage of position before the battle is joined or exploiting tactical success to achieve operational or strategic results."²² Operational fires are the application of firepower to create a decisive impact against uncommitted enemy forces before battle is joined or creating areas facilitating maneuver to achieve operational results. Operational intelligence is the identification and collection of information which provides friendly forces an advantage in time, space, and action over the enemy before battle is joined or exploits tactical intelligence gathered during battle which has operational significance. Operational intelligence seeks to find the enemy's center of gravity and decisive points within the theater of operations. Conversely, operational protection seeks to preserve the friendly force's center of gravity and concentration by internal measures. These conservation measures allow the force concentration to be applied to the designated military objectives at the decisive time.

Operational protection applies to every facet through the use of active measures such as air defense systems and passive measures such as operations security measures, engineering efforts, and NBC defense. Operational deception is the application of physical assets, cybernetic processes, and moral factors to create a decisive impact against the enemy commander and his uncommitted forces before battle is joined or creating areas that allow exploitation of a tactical success to achieve operational results. Operational deception ultimately seeks either to protect the friendly force's center of gravity or to make the enemy's center of gravity vulnerable by manipulating the enemy's perceptions and expectations.

Operational support provides forces the ability to conduct operations until mission accomplishment. Operational support ultimately translates to the ability of friendly forces to initiate and sustain operations to a greater degree than the enemy can initiate or sustain--the ability to move troops and supplies through a various modes of transportation that support the operational concept. Operational organization is the fitting of the means to the tasks at hand. Its focus becomes the requirements for and intended result of campaigns and major operations. This variant of command and control is not derived from a given force structure or tactical wiring diagram. Rather at the operational level, it suggests organizing a force as a whole and organizing a staff to optimize the application of force in time, space, and aim. In that respect, organization is concerned with integration and synchronization of

joint and combined forces to achieve operational results.

ANALYSIS OF FUNCTIONS

Each of the four sets of functions, FM 100-5, Operations; FM 100-6, Large Unit Operations (Coordinating Draft); TRADOC Pamphlet 11-9, Blueprint of the Battlefield (OOS); and the Davis model, will be analyzed against seven criteria determining its relative degree of utility and adequacy. The functions in each set are displayed at Appendix B. The analytical criteria chosen for evaluating the selected sets of operational level functions include three general and four specific standards.

The three general standards are comprehensiveness, mutual exclusiveness, and simplicity. Functions which are comprehensive imply an all-embracing scope of coverage, i.e. nothing essential is omitted. Simplicity conveys the notion that a relatively small number of commonly understood categories is to be preferred over a large number of categories requiring special definition. Because of their collective nature, comprehensiveness and simplicity will be applied to the set of functions "as a whole", rather than to individual functions within the set. Functions which are mutually exclusive suggest a singular effect. Mutual exclusiveness infers a limited or restrictive overlapping with other compared elements. For this reason, mutual exclusiveness is evaluated against individual functions listed within the set.

The four specific criteria were chosen for their direct

applicability to operational art. The first is cross service compatibility among the Army, Navy, Air Force, and Marines Corps. This is essential since in American practice operational art is almost invariably joint. The second standard is theory basis and history. The third criterion is the ability to degrade the enemy's capabilities categorized as the domains of war--physical, cybernetic, and moral. The final criterion is its defined relevance to operational art--whether doctrine has adequately defined the function and its intended purpose. Because of the individualistic nature of each specific criterion, all four are evaluated against the individual functions within each set. Of the seven criteria (Appendix C) a higher degree of importance is assigned to the three general criteria. This weighted value is based on a belief that logical thought and a reasonable distinction among different functions are paramount.

Appendix D-1 capsulates the results of the analysis. Also, the detailed evaluation and numerical assessments supporting the summary are annexed. The methodology for explaining the results follows two paths. First is an explanation of findings horizontally--by criteria--describing the rank order and mitigating factors. Second is a similar review of the findings only vertically--by total set.

In comprehensiveness (all-embracing scope of coverage--nothing essential is omitted), the rank order from high to low was FM 100-5, Davis model, ODS, and FM 100-6. FM 100-5 provided a highly comprehensive number of functions covering numerous aspects. The

Davis model presented a lesser number of functions, OOS even fewer. Finally, FM 100-6 because of its brevity, suggested a limited scope and perhaps an inadequacy in covering the subject.

In simplicity (relatively small number of commonly understood categories is to be preferred over a large number of categories requiring special definition), the rank order from high to low was FM 100-6 and OOS, Davis model, and FM 100-5. FM 100-6 and OOS led the ratings because of their relatively low number of pertinent, easily understood categories of functions. The Davis model contained a slightly higher number of detailed functions. FM 100-5, although previously rating highest in comprehensiveness, ranked lowest in simplicity with 17 functional activities requiring special definitions for each.

In mutual exclusiveness (limited or restrictive overlapping with other compared elements), the rank order from high to low was FM 100-6, the Davis model, OOS, and FM 100-5. FM 100-6 contained 2 overlapping combinations within the set. The Davis model and OOS both revealed 6 overlapping combinations within each set. Finally, FM 100-5 was rated lowest, containing 36 overlapping combinations within the set and suggesting an inadequacy in grouping functions under different titles.

In cross-service compatibility, the rank order from high to low was the Davis model and FM 100-6, OOS, and FM 100-5. The functions listed in both the Davis model and FM 100-6 were evaluated as applicable to joint operations based on their orientation to concepts

rather than specific forces or equipment. The function of 'movement and maneuver' in OOS presented difficulty in its translation and application to naval and air forces. Finally, FM 100-5 contained numerous single service functions or functions which have differing service related performance criteria such as engineer support, tactical air operations, psychological operations, amphibious operations, and SDF.

In theoretical and historical basis, the rank order from high to low was the Davis model and OOS, FM 100-6, and FM 100-5. Both the Davis model and OOS expressed the similar functions derived from the theoretical and historical analysis. The term 'sustainment', presented in FM 100-6 and often referred to as logistics or support, suggested more of a force characteristic inference than a function or activity. Finally, FM 100-5 was rated lowest, containing the fewest number of identified operational level functions as outlined in Appendix A. The functions outlined in this doctrinal manual aligned more with operations that are asset and force oriented rather than objective oriented. Examples are electronic warfare, tactical air operations, joint suppression of enemy air defense, engineer support, air defense, and special operating forces.

In attacks/directed at a domain of war, the rank order from high to low was the Davis model, FM 100-6, FM 100-5, and OOS. The strength of the Davis model (as well as the closely ranked FM 100-6) is aligned to the physical destruction, cybernetic disruption, and moral decline of the enemy. The wording of the functions outlined in

FM 100-5 infers only a indirect application to the domains--i.e. special operating forces, airspace coordination, civil-military operations, reconstitution, or communications. Finally, the term 'command and control', outlined in OOS and integral to cybernetics, was evaluated as a process, oriented toward preserving the integrity of a friendly force and its operations rather than against a specific dominion of the enemy.

Finally, in defined utility at the operational level, the rank order from high to low was FM 100-6 and the Davis model, OOS, and FM 100-5. Both the Davis model and FM 100-6 outlined in specific terminology, the utility and application of prescribed functions to operational art. These focused definitions provided a much needed framework for understanding the subordinate relationship of functions to operational art. In OOS the degree of definition was less visible. Finally, FM 100-5 was rated lowest because of its defined orientation toward tactical actions, not operational art.

CONCLUSIONS

Switching to the vertical analysis of each set against all seven criteria, the overall ranking of sets from high to low was the Davis model, OOS, FM 100-6, and FM 100-5. Cumulative analytical scores are listed at page D-1. The Davis model's top strengths were its cross-service compatability, derivation from theory and history, orientation toward the domains of war, and explicit utility at the operational level. It ranked second in comprehensiveness and mutual

exclusiveness. It could be summarized as containing the best from each theory, history, and contemporary doctrine. The strengths of the OOS were its simplicity and direct relationship to theory and history. Strong ratings were received in mutual exclusiveness and cross-service compatability. However, some evidence suggests the inclusion of deception as subordinate function of operational protection is inappropriate in terms of mutual exclusiveness. In FM 100-6, the strengths resulted from its simplicity, mutual exclusiveness, cross-service compatability, and defined utility at the operational level. However, offsetting this qualities was its lack of comprehensiveness. Upon closer examination the lack of any function directed toward the control or protection of a force suggests a set of functions slightly too comprehensive. FM 100-5 was rated lowest, lacking simplicity, cross-service compatability, defined utility at the operational level, and a theoretical or historical basis for many of its supporting functions. Its only strength was its comprehensiveness. FM 100-5's ranking as least adequate comes from its orientation toward numerous tactical operations, actions, and assets. In conclusion, the Davis model was analytically assessed as the best listing of the fundamental functions of operational art. These functions are maneuver, fires, intelligence, protection, deception, support, and organization.

IMPLICATIONS

The implications of having determined the fundamental functions

of operational art are three-fold. First, functions, used in conjunction with the three elements of operational design, should form the foundation for building a campaign plan. The operational artist must constantly ask and answer the question, "What are the fundamental functions my force must perform to execute the actions required to reach my goal?" Future editions of our doctrine should contain not only this methodology, but also a better descriptive analysis of the fundamental functions that link strategic aims to tactical actions.

Second, the process of organizing forces and staffs to accomplish the derived function should be examined--the realignment of forces and assets under a appropriate, functionally organized staff. Under the functional approach, various services or branches of a service would assume control of or release forces and assets to accomplish a specified function. For example, staffs and forces organized for the operational function of deception would task organize intelligence, counterintelligence, signal assets, naval vessels, combat aircraft, special operation forces, and combat forces to accomplish its requirements. The related staff would be composed of joint, functional experts from the same agencies. Overall command and control would rest with the service who logically should control the operations. It is recognized that the adoption of this approach would add to rather than decrease the size of staffs. However, the establishment of permanent joint commands and staffs aligned and trained to perform a designated function could significantly enhance

the quality of major operations and campaigns.

Third, training forces and staffs to plan and conduct campaigns and major operations using a functional approach is paramount to success. A commander and his staff practicing operational art at any level should understand the advantages of viewing the theater in terms of functions. With that knowledge, unity of effort, synchronization, and the integration of the elements of combat power in time, space, and aim are assured in achievement of the strategic ends.

ENDNOTES

¹J.F.C. Fuller, "Tactics and Mechanization", Infantry Journal, May 1927, p. 460.

²U.S. Army Field Manual 100-5, Operations, Department of the Army, Washington D.C., 1986, p. 10.

³L.D. Holder, "Catching Up with Operational Art", AMSF Course 3, The Contemporary Practice of Operational Art, Introduction to Operational Art, AY 88/89, U.S. Army Command and General Staff College, Ft. Leavenworth, KS, p. 6.

⁴William W. Mendel and Floyd T. Banks, "Campaign Planning: Getting It Straight", Parameters, September 1988, p. 47.

⁵L.D. Holder, op. cit., p. 6.

⁶U.S. Army Field Manual 100-5, Operations, Department of the Army, Washington D.C., 1986, p. 12.

⁷Ibid., p. 10. (FM 100-5, Operations actually addresses these considerations as questions that the commander must answer. FM 100-6, Large Unit Operations (Coordinating Draft) specifically use the term elements of operational design and summarizes those questions into concepts.)

⁸James J. Schneider, "The Theory of Operational Art", Theoretical Paper Number 3, School of Advanced Military Studies, U.S. Army Command and General Staff College, Ft. Leavenworth, KS., 1 March 1988, p. 8-11.

⁹Conversation with Dr. Harold R. Winton, School of Advanced Military Studies, Ft. Leavenworth, KS., 29 March 1990.

¹⁰J.F.C. Fuller, op. cit., p. 460.

¹¹Ibid., p. 460-461.

¹²Ibid., p. 461.

¹³"To blind" in this instance can be associated with a current tactical term of counter-reconnaissance. Ultimately, any measure to prevent the enemy from finding us is a precondition for a grouping of activities called deception.

¹⁴Sun Tzu, The Art of War, translated by Samuel B. Griffith, Oxford

University Press, 1963, p. 106.

¹⁵Ibid., p. 145.

¹⁶Ibid., p. 106.

¹⁷Ibid., p. 77-78.

¹⁸Ibid., p. 85.

¹⁹Ibid., p. 66.

²⁰Baron de Jomini, Summary on the Art of War, Reprint G.P. Putnam and Company, New York, 1854, p. 200.

²¹Ibid., p. 88-89.

²²Ibid., p. 225 (I suggest that the term 'strategic' refers in modern day terms to 'operational'). Author added italics to highlight secondary requirement hidden in text.

²³Ibid., p. 228.

²⁴Ibid., p. 275.

²⁵FM 100-5, Operations, p. 10.

²⁶L.D. Holder, op. cit., p. 6.

²⁷J.F.C. Fuller, Grant and Lee: A Study in Personality and Generalship, Indiana University Press, Bloomington, IN, 1982, p. 174.

²⁸Edward Hagerman, The American Civil War and the Origins of Modern Warfare, Indiana University Press, Bloomington, IN, 1988, p. 200.

²⁹Ibid., p. 201.

³⁰Ibid., p. 210.

³¹John Toland, No Man's Land, 1918, The Last Year of the Great War, Doubleday and Company, Inc., Garden City, New York, 1980. p. 214-217.

³²Frederick Palmer, America in France, John Murray, Albemarle Street W. London, 1919, p. 333-334.

³³Dupuy and Dupuy, The Encyclopedia of Military History, p. 977.

³⁴Ibid., p. 982.

³⁵Ibid.

³⁶Ibid.

³⁷Toland, op. cit., p. 424.

³⁸Ralph C. Antrim, "Evolution of the American Field Army", U.S. Army Command and General Staff College Study, CARL, 1961, p. 24-29.

³⁹Charles Cruickshank, Deception in World War II, Oxford Publishing Co., New York, 1980, p. 96.

⁴⁰Ibid.

⁴¹The Second World War: Europe and the Mediterranean. The West Point Military History Series, Department of History, U.S. Military Academy, West Point, Avery Publishing Group, Inc., Wayne, N.Y., 1989. p. 256.

⁴²Ibid., p. 256.

⁴³Ibid., p. 273.

⁴⁴Cruickshank, op. cit., p. 159.

⁴⁵The Second World War: Europe and the Mediterranean, p. 256.

⁴⁶Ibid., p. 349.

⁴⁷Ibid.

⁴⁸Eddy Bauer, The Marshall Cavendish Illustrated Encyclopedia of World War II, Marshall Cavendish Corporation, New York, Orbis Publishing, 1972, p. 1913.

⁴⁹Dupuy and Dupuy, op. cit., p. 1108.

⁵⁰Ibid., p. 1109.

⁵¹Ibid.

⁵²ATP 35(A), Land Force Tactical Doctrine, NATO Unclassified, March 1984, p. 1-1.

⁵³U.S. Army, "AirLand Battle Future Umbrella Concept (Draft)," Concepts and Force Alternatives Directorate, Fort Leavenworth, KS, p. 12.

⁵⁴FM 100-5, Operations, p. 40.

²²Ibid., p. 11.

²⁴Command and General Staff College, "Field Manual 100-6, Large Unit Operations" (Coordinating Draft), U.S. Army Command and General Staff College, Ft. Leavenworth, KS., 30 September 1987, p. 3-7.

²⁷Department of the Army, TRADOC Pamphlet 11-9, Blueprint of the Battlefield, Headquarters, United States Army Training and Doctrine Command, Ft. Monroe, VA., 9 June 1989, p. 4-1.

²⁸Ibid., p. 4-2. This quote is given as the definition of operational movement and maneuver. I have selected it as an appropriate definition for operational maneuver.

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1. Appendix A: Matrix of Theoretical and Historical Functions.

2.

<u>FUNCTION</u>		<u>Theory</u>	<u>Civil</u> <u>War</u>	<u>World</u> <u>War I</u>	<u>World</u> <u>War II</u> (Jael/Truscott)	
To discover, foresee, know	-	X	X	X	X	X
To deceive or blind	-	X	X		X	X
To surprise	-	X		X		
To move or maneuver	-	X	X	X	X	X
To organize	-	X		X	X	X
To control	-	X	(direct)	(direct)	C2	C2
To smash, attack, hit	-	X		X	X	X
To hold	-	X			X	X
To protect or secure	-	X	X		X	X
To support	-	X	X	X	X	X

1. Appendix B: Listings of Operational Level Activities

2.

	FM 100-5	FM 100-6	OCS	DAVIS	
Maneuver	*	*		*	Maneuver
Movement and Maneuver			*		Movement and Maneuver
Fires	*	*	*	*	Fires
Intelligence	*	*	*	*	Intelligence
Deception	*	*		*	Deception
Protection			*	*	Protection
Electronic Warfare	*				Electronic Warfare
Command and Control			*		Command and Control
Communications	*				Communications
Reconstitution	*				Reconstitution
Logistics	*				Logistics
Sustainment		*			Sustainment
Support			*	*	Support
J-SEAD Operations	*				J-SEAD Operations
Air Defense	*				Air Defense
Tac Air	*				Tac Air
Operations					Operations
Engineer Support	*				Engineer Support
Airspace	*				Airspace
Coordination					Coordination
Psychological	*				Psychological
Operations					Operations
Amphibious	*				Amphibious
Operations					Operations
Civil-Military	*				Civil-Military
Operations					Operations
SOF	*				SOF
Organization				*	Organization
	17	5	6	7	

1. Appendix C: Selected Criteria and Weighted Values

2. GENERAL CRITERIA

Importance Value

Comprehensive	(2)
Simplicity	(2)
Mutually exclusive	(2)

3. SPECIFIC CRITERIA

Cross-service compatability
Theory/history based function
Attacks/directed at a domain of war
Defined utility within operational art

1. Appendix D: Summary of Average Scores

2.

	FM 100-5	FM 100-6	OOS	DAVIS
Comprehensive (2)	20	8	12	16
Simplicity (2)	8	16	16	14
Mutually Exclusive (2)	12	18.8	17.3	18
Cross Service Compatability	8.2	10	9.8	10
Theory/History Based Functions	5.2	9.6	10	10
Attacks/Directed at Domain of War	7.8	8.6	7.3	8.7
Defined Utility at Opnl Level	6.6	9	8.7	9
	9.7	11.4	11.6	12.2

1. Appendix D: Evaluation of Selected Sets Against Two General Criteria

2.

		FM 100-5	FM 100-6	OOS	DAVIS
Comprehensive	(2)	10 (20)	4 (8)	6 (12)	8 (16)
Simplicity	(2)	4 (8)	8 (16)	8 (16)	7 (14)

2. Evaluation of functions listed within each doctrinal manual or hypothesis.

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 G
 P
 R
 M
 O
 NOTE:
 X = Yes, ? = Some degree
 0 = No degree
 Mutually Exclusive (2)
 Overlapping Functions
 (0) (0) (0) (3) (4) (3) (3) (6)
 Fires : CA : Intell
 Airspac : Amphib : Airspace
 Air Def : Maneuve : Deception
 Air Def : Tac Air :
 Fires : Airspac :
 Airspace : Fires : Psy Ops
 EW : EW :
 CA :

Value (1-10)	10	10	10	4	4	8	8	3	---Continued on Next Page---
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2. Evaluation of functions listed within each doctrinal manual or hypothesis.

D-4

2. Evaluation of functions listed within each doctrinal manual or hypothesis.

D-5

2. Evaluation of functions listed within each doctrinal manual or hypothesis.

The diagram illustrates the relationship between mutually exclusive and overlapping functions in a cryptographic system. It consists of a grid of functions (A-M) and a table of values (1-10).

Mutually Exclusive (2)

X	X	X	?	X
(0)	(0)	(1)	(1)	(0)

Overlapping Functions

Intell
Decpt

Value (1-10)

10	10	9	8	10
----	----	---	---	----

AVERAGE

18.8

2. Evaluation of functions listed within the hypothesis.

Mutually Exclusive (2)

Overlapping Functions

Value (1-10)

= 6 overlapping combinations

18.0
;
AVERAGE

1. Appendix D: FM 100-5, Operations

2. Evaluation against specific criteria.

	R	E	V	S	L	I	A	S	D	F	E
	E	E	E	E	E	N	A	R	T	D	M
	N	R	T	C	P	E	G	P	R	I	M
	A	I	N	A	O	S	N	S	I	O	C
	M	F	I	T	J-	E	A	C			
Cross Service Compatibility	10	10	10	6	9	7	10	10			
Theory/History Based Function	10	10	10	2	2	5	5	8			
Attacks/Directed at Domain of War	10	10	5	10	10	10	10	10			
Defined Utility at Opnl Level	10	7	10	10	3	5	6	5			
TOTAL	40	37	35	28	24	27	31	33	---CONTINUED NEXT PAGE---		
AVERAGE	10.0	9.3	8.8	7.0	6.0	6.8	7.8	8.3			

1. Appendix D: FM 100-5, Operations, Con't

2. Evaluation against specific criteria.

	C N I E O N C I O E T A T R R S B - T P D P T A N H I L S S R E C F O C N H I I R O C E R C Y P P N F V L G I O E L A E S O M P O I I O A C D E W R P A O S C M L											
											SUM	AVG
Cross Service Comptability	10	10	10	8	6	4	5	4	10		139	8.2
Theory/History Based Function	2	10	5	2	2	2	2	2	10		89	5.2
Attacks/Directed at Domain of War	3	10	8	6	7	8	3	4	8		132	7.8
Defined Utility at Opnl Level	2	10	10	5	5	7	5	4	8		112	6.6
TOTAL	17	40	33	21	20	21	15	14	36			6.9
AVERAGE	4.3	10.0	8.3	5.3	5.0	5.3	3.8	3.5	9.0			6.9

2. Evaluation of specific criteria.

D-10

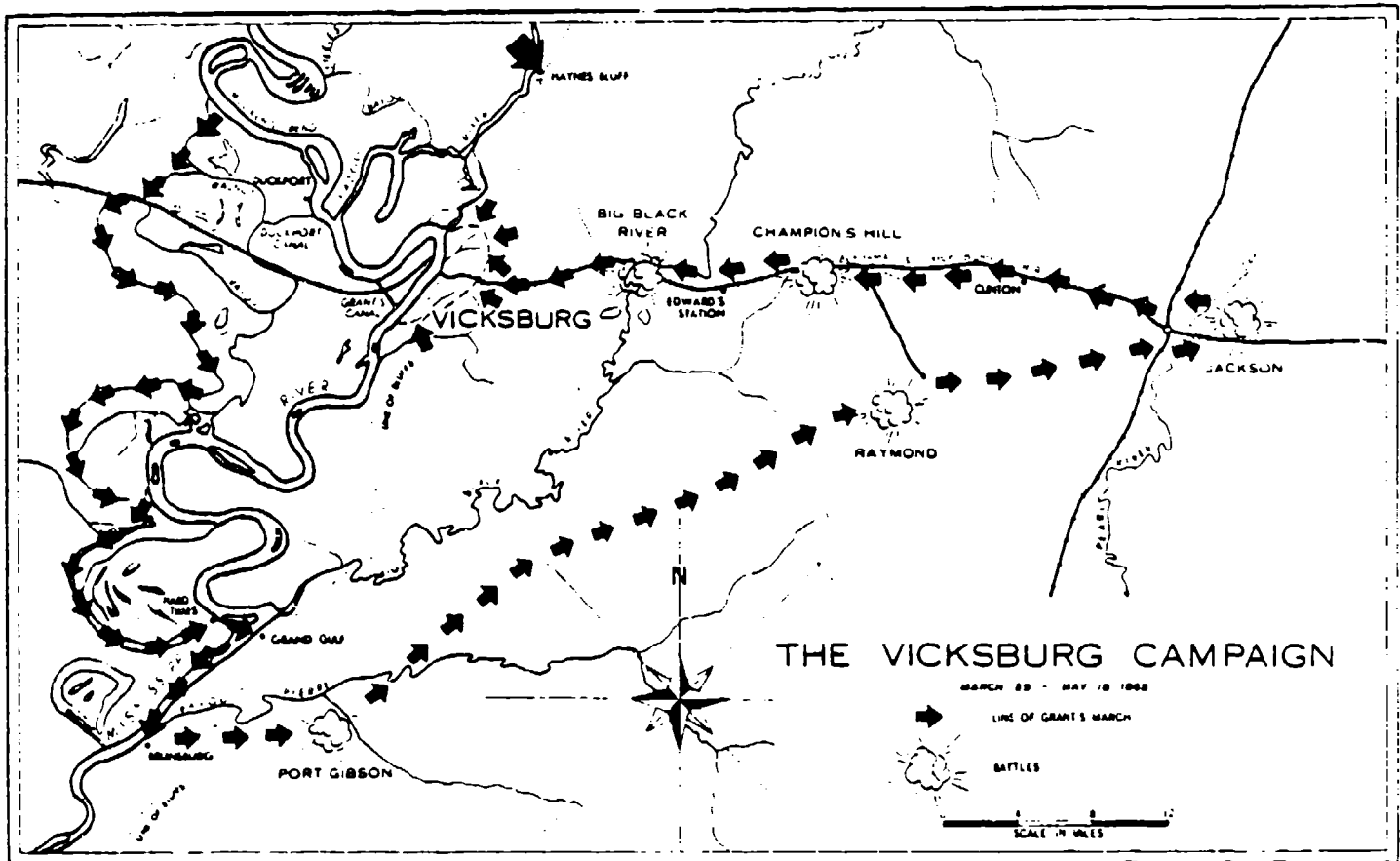
- ## 2. Evaluation against specific criteria.

2. Evaluation against specific criteria.

D-12

1. Appendix E: American Civil War

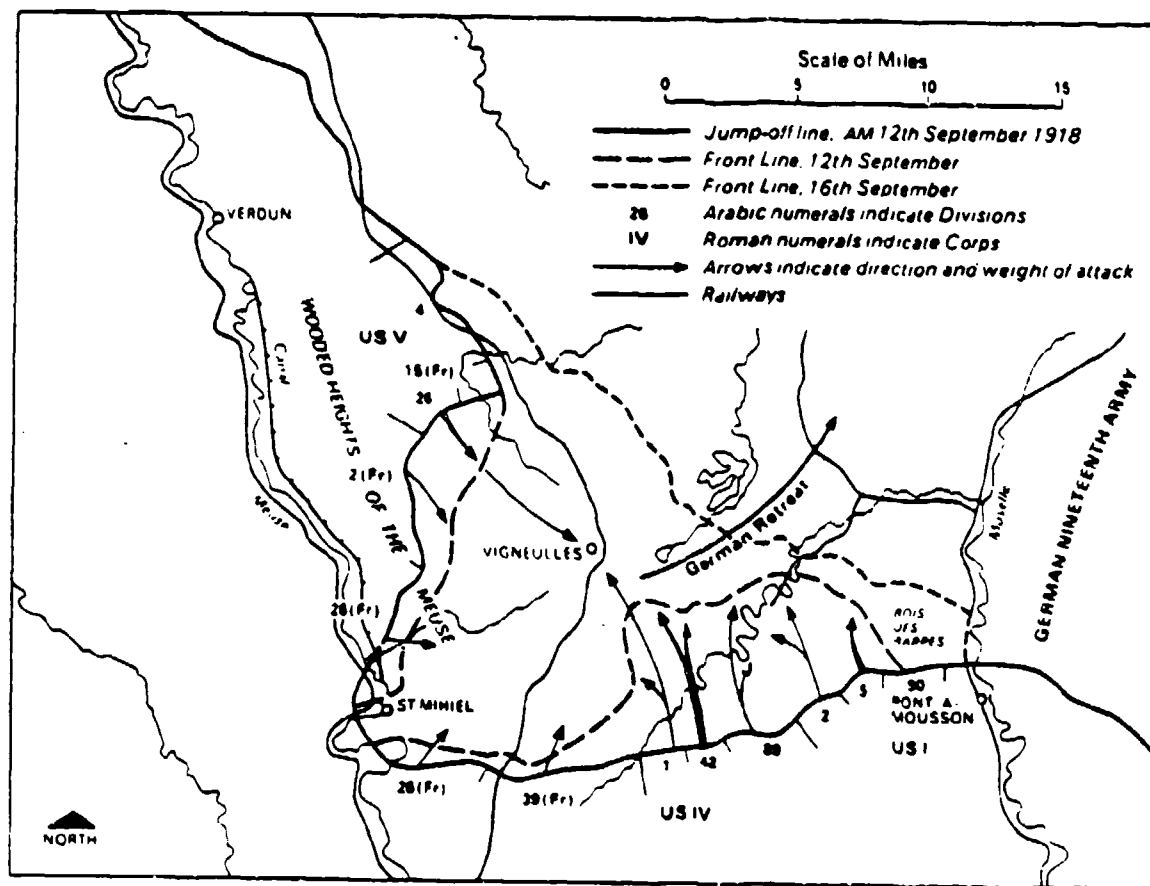
2.



3. Source: Wheeler, Richard The Siege of Vicksburg, Thomas Y. Crowell Co., New York, 1987, p. 100.

1. Appendix E: World War I

2.

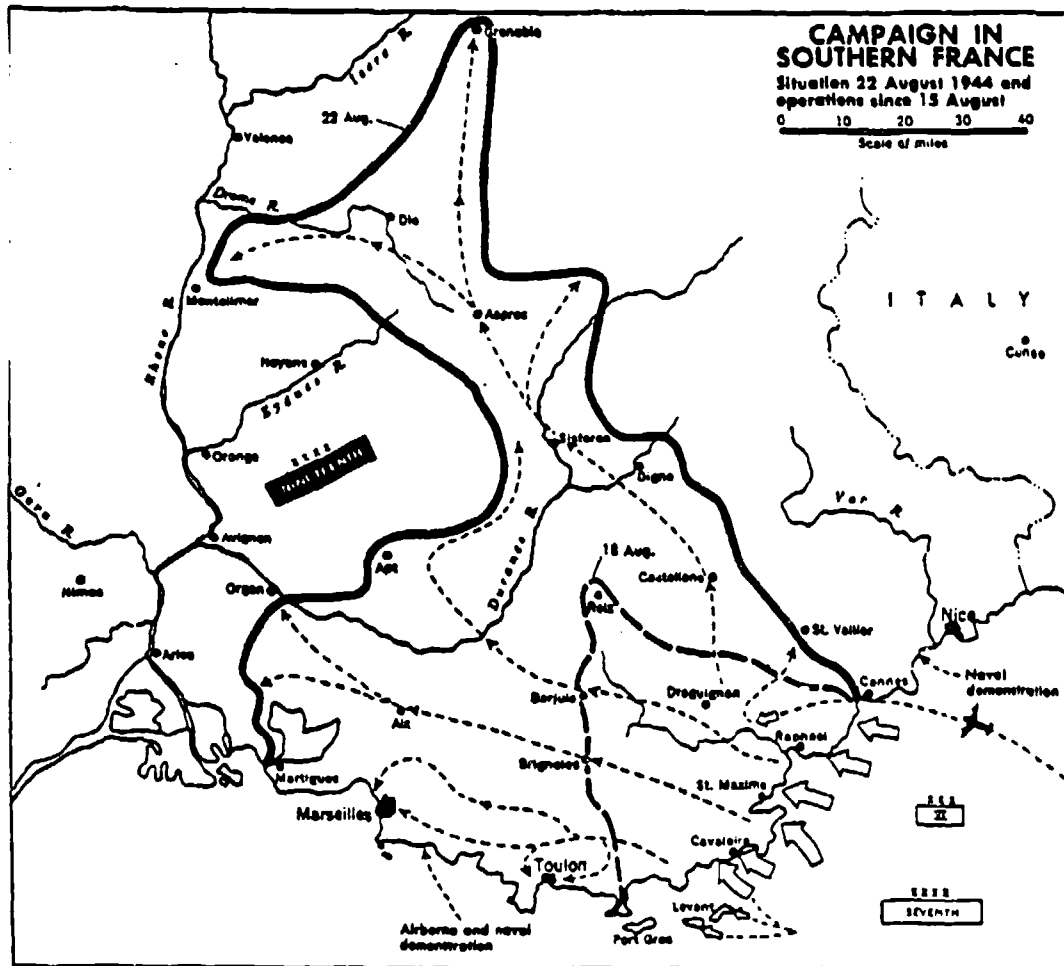


St Mihiel: Allied offensive, September 1918

3. Source: Brook-Shepard, Gordon November 1918, Little, Brown and Co., Boston, 1981, p. 95.

1. Appendix E: World War II

2.



3. Source: Dupuy and Dupuy, The Encyclopedia of Military History, Harper and Row Publishers, New York, 1986, p. 1109.